

I claim:

(clm5re4a)

1. A method for improving the combustion efficiency of a combustion mechanism operating with fluid hydrocarbon fuel, having an ignition and combustion area therein to convert said fuel into heat, thrust, torque or other type of energy, resulting in the reduction of fuel consumption and harmful emissions without effecting performance output of the combustion mechanism, comprising:

- a) providing a constant volume of ambient temperature fluid hydrocarbon fuel as fuel for said combustion mechanism;
- b) directing said constant volume of fuel through a primary fuel supply conduit defining a fuel heat exchanger assembly that extends through a heating zone having a fuel inlet and a fuel outlet;
- c) reducing fuel density by reducing fuel mass in said constant volume of fuel through heating the fuel to an optimal operating temperature of between 100 degrees Fahrenheit and the fuel's auto-ignition temperature as it flows through said fuel heat exchanger assembly;
- d) maintaining a constant volume of heated low density fuel for ignition in the combustion area of said combustion mechanism;
- e) providing a constant volume of ambient temperature air as combustion air for said combustion mechanism.
- f) directing said constant volume of combustion air through a primary air supply conduit defining an air heat exchanger assembly that extends through a cooling zone having an air inlet and an air outlet.
- g) increasing air density by increasing air mass in said constant volume of combustion air through cooling the combustion air to an optimal operating temperature of between combustion mechanism ambient temperature and minus 40 degrees Fahrenheit as it flows through said air heat exchanger assembly;
- g) maintaining a constant volume of cooled high density air for combustion in the combustion-area of said combustion mechanism;

2. A method according to Claim 1, wherein the fuel heat exchanger assembly is operated with heat generated from the combustion mechanism.

3. A method according to Claim 1, wherein the fuel heat exchanger assembly is operated with means other than heat generated from the combustion mechanism.
4. A method according to Claim 1, wherein the preselected optimal fuel operating temperature level is at a constant range between 155 degrees Fahrenheit and 900 degrees Fahrenheit.
5. A method according to Claim 1, wherein the combustion air heat exchanger assembly is operated with low temperature generated from the flow of the low temperature fuel supply.
6. A method according to Claim 1, wherein the combustion air heat exchanger assembly is operated with means other than the flow of the low temperature fuel supply.
7. A method according to Claim 1, wherein the preselected optimal combustion air operating temperature level is maintained at a constant range between plus 30 and minus 40 degrees Fahrenheit.
8. A method according to Claim 1, wherein the combustion mechanism is a furnace.
9. A method according to Claim 1, wherein the combustion mechanism is a process heater.
10. A method according to Claim 1, wherein the combustion mechanism is a water heater.
11. A method according to Claim 1, wherein the combustion mechanism is a hydronic boiler.
12. A method according to Claim 1, wherein the combustion mechanism is a warm air heater.
13. A method according to Claim 1, wherein at least one heat exchanger assembly is operational.
14. **A combination of devices** operational in accordance with the disclosed method for improving the combustion efficiency of a combustion mechanism operating with fluid hydrocarbon fuel, having an ignition and combustion area therein to convert said fuel into heat, thrust, torque or other type of energy, providing the means for the reduction of fuel consumption and harmful emissions without effecting performance output of the combustion mechanism, comprising:
 - a) a first housing means defining a heating zone;

- b) a fuel supply conduit defining a fuel heat exchanger assembly extending through said heating zone, providing the primary conveyance of fuel to the combustion area of the combustion mechanism, having a fuel inlet and a fuel outlet
- c) a fuel heat exchanger assembly to maintain a constant volume of low density fuel supply to the combustion area of said combustion mechanism at a preselected optimal operating temperature range of between 100 degrees Fahrenheit and the fuel's auto-ignition temperature;
- d) means to maintain a constant volume of low density heated fuel for combustion in the combustion area of said combustion mechanism;
- e) a second housing means defining a coling zone;
- f) a combustion air supply conduit defining a combustion air heat exchanger assembly extending through said cooling zone, providing the primary conveyance of combustion air to the combustion area of the combustion mechanism, having an air inlet and an air outlet;
- g) a combustion air heat exchanger assembly to maintain a constant volume of high density cooled combustion air supply to the combustion area of said combustion mechanism at a preselected optimal operating temperature range of between ambient and minus 40 degrees Fahrenheit;
- h) means to maintain a constant volume of high density cooled air for combustion in the combustion area of said combustion mechanism.

15. A heating zone according to Claim 14, wherein the fuel heat exchanger assembly is operated with heat generated from the combustion mechanism.

16. A heating zone according to Claim 14, wherein the fuel heat exchanger assembly is operated with means other than heat generated from the combustion mechanism.

17. A fuel heat exchanger assembly in a heating zone according to Claim 14, designed to heat the fuel to a preselected optimal constant fuel operating temperature level of between 155 degrees Fahrenheit and 900 degrees Fahrenheit.

18. A cooling zone according to Claim 14, wherein the combustion air heat exchanger assembly is operated with low temperature generated from the flow of the low temperature fuel supply.

19. A cooling zone according to Claim 14, wherein the combustion air heat exchanger assembly is operated with means other than the low temperature of the fuel supply flow.
20. A combustion air heat exchanger assembly in a cooling zone according to Claim 14, designed to cool the combustion air to a preselected optimal constant combustion air operating temperature level of between plus 30 and minus 40 degrees Fahrenheit.
21. A combination of devices according to Claim 14, wherein the combustion mechanism is a furnace.
22. A combination of devices according to Claim 14, wherein the combustion mechanism is a process heater.
23. A combination of devices according to Claim 14, wherein the combustion mechanism is a water heater.
24. A combination of devices according to Claim 14, wherein the combustion mechanism is a hydronic boiler.
25. A combination of devices according to Claim 14, wherein the combustion mechanism is a warm air heater.
26. A combination of devices according to Claim 14, wherein at least one heat exchanger assembly is operational.